EIGHTEEN YEARS OF RESEARCH AT ILLINOIS (Cont.)

In 1937 Hellman had published a study based on a group of normal occlusions. Prior to this time the prevailing concept had held that if the occlusion of the teeth were normal the face would be normal. No one, however, had attempted to describe this normal face although there was a rather general idea that it would be pleasing in its proportions and would not deviate markedly from generally accepted standards. Hellman's study proved, on the contrary, that individuals who had normal occlusion as a common characteristic could show wide deviations from each other in every other measure. This finding, being rather disturbing, was largely ignored by the orthodontist.

Dr. Downs has been working for the past several years on a system of more objective case analysis and treatment planning. You are going to hear more of it during this meeting and I do not intend to divulge any advance information about it at this time except to say that he has taken into account a number of the anatomical variables with which we have to deal and has sought to determine their range and their possible correlations with each other. Some of this work was assigned to Dr. Emli Bushra who wrote his thesis under the title:

Variations In the Human Facial Pattern In Norma Lateralis

EMIL BUSHRA, D.D.S., M.S.

Chicago, Illinois

A study of the variations and relations of components of the craniofacial skeleton provides a fundamental basis for orthodontic diagnosis and prognosis. Specifically, the objectives of this investigation were to determine (1) the degree to which the face swung out from under the cranium, (2) the variability and correlations in intra-facial relationships, (3) the variability and correlations in dento-cranial relationships, (4) the variability and correlations within the denture.

Forty individuals with excellent dental occlusions and derived from mixed stock were assessed by the method of roentgenographic cephalometry. The investigation was confined to norma lateralis. Tracings of the roentgenograms were made and the angular relations between an extensive series of planes were recorded. These were then subjected to statistical analysis.

The standard deviation, which was regarded as the most significant index of angular variability, ranged from 1.7° to 7.3° (Table I). The sella-turcica-gnathian-nasion angle (S. Gn. N) showed the least variation while the relation of the axes of the upper and lower incisors showed the greatest variation. In general the craniofacial angles and the angle nasion-sella-turcica-maxillary first molar (N-S-$\underline{6}$) showed the lowest variability.

The coefficient of correlation between the various angles was developed (Table II). A number of correlations were established. The highest correlation was found between the facial angle and the angle formed by the occlusal plane and the Frankfort plane (—.76). Other good correlations

were demonstrated between the nasion-sella-turcica-Frankfort plane and the nasal floor—Frankfort plane angle plane (—.69); between the mandibular plane-Frankfort angle and the occlusal plane-Frankfort plane angle (—.69); and between the mandibular plane-Frankfort angle and the facial angle (—.69). This indicates that the more the face protrudes the more horizontal the occlusal plane and mandibular plane become. The facial plane, the line N-S, the nasal floor, the occlusal plane and the mandibular plane tend to behave in a similar manner.

While this investigation showed that no plane, angle or relationship was invariable enough to be used as an infalliable diagnostic guide the tendencies noted should be helpful in establishing a tentative base for the analysis and prognosis of malocclusions.

TABLE I

CLASSIFIED VARIABILITIES

Angle	*Mean*	*Range*	*S.D.*	*C.V.*
		Low Variation		
S-GN-N	33.8 ± .28	31.3- 38.0	1.73	5.11
B-N to FP	21.5 ± .49	14.5- 30.2	3.12	14.51
S-GN to MP	36.3 ± .49	27.0- 42.3	3.15	8.67
N-S-6	66.3 ± .53	58.6- 72.3	3.37	5.08
N-S-$\overline{Gn}$	65.7 ± .54	58.0- 73.2	3.42	5.25
		Moderately Low Variation		
A-B to OCC	87.5 ± .57	79.0- 94.8	3.63	4.14
N-S to FP	6.5 ± .59	0.6- 14.0	3.73	57.21
S-N-NS	88.0 ± .62	79.3- 97.3	3.80	4.31
N-NS-PNS	83.4 ± .62	75.5- 92.0	3.92	4.70
Facial angle	88.6 ± .63	78.3- 95.5	3.96	4.46
N-PG to MP	69.0 ± .64	60.0- 78.8	4.06	5.88
B-S to FP	39.5 ± .65	30.5- 52.3	4.11	10.40
OCC to FP	8.4 ± .66	—2.8- 16.0	4.13	49.16
S-Gn to FP	59.3 ± .66	51.5- 70.0	4.15	6.99
LMA to OCC	82.9 ± .67	73.6- 92.0	4.21	5.07
N-S to MP	29.2 ± .71	20.5- 40.0	4.50	15.41
		Moderately High Variation		
NS-PNS to FP	2.7 ± .75	—9.6- 11.0	4.73	175.18
UMA to LMA	172.8 ± .75	164.0-184.3	4.74	2.74
UIA to OCC	62.9 ± .78	50.0- 77.0	4.92	7.82
Angle of convexity	180.1 ± .78	171.0-194.0	4.95	2.75
Gonial angle	118.1 ± .79	111.0-130.0	5.03	4.24
1-GN to MP	78.4 ± .80	63.9- 87.8	5.04	6.42
UMA to OCC	89.8 ± .80	73.0- 98.5	5.05	5.62
MP to FP	22.7 ± .81	13.0- 37.0	5.15	22.68
OCC to 1-GN	86.9 ± .83	73.2-100.0	5.24	6.02
NS-$\overline{1}$ to OCC	87.5 ± .85	77.5-102.9	5.38	6.14
LIA to OCC	72.5 ± .91	57.0- 90.0	5.75	7.93
PNS-NS-$\overline{1}$	86.8 ± .93	75.3- 96.8	5.85	4.43
		High Variation		
LIA to MP	92.6 ± .97	79.5-104.0	6.15	6.64
UIA to LIA	135.3 ± 1.15	118.0-152.0	7.32	5.41

S.D. = standard deviation.
C.V. = coefficient of variation.

TABLE II

Classified Correlations

Angles	*r*	*r* / *P Er*
Excellent Correlations		
Facial angle and OCC to FP	—.7756 ± .04	19.2
N-S to FP and NS-PNS to FP	—.6950 ± .05	13.9
MP to FP and OCC to FP	.6922 ± .05	13.8
MP to FP and Facial angle	—.6920 ± .05	13.8
Good Correlation		
N-S to FP and Facial angle	.6668 ± .06	11.1
N-PG to MP and LIA to MP	.6375 ± .06	10.5
MP to FP and Gonial angle	.6263 ± .06	10.3
N-PG to MP and Gonial angle	—.5988 ± .06	9.8
Small Correlations		
Angle of Convexity and LIA to OCC	—.5313 ± .07	7.6
Angle of Convexity and A-B to OCC	.5182 ± .08	6.3
N-S-GN and N-S to MP	.4982 ± .08	6.2
Angle of Convexity and Facial angle	—.4863 ± .08	6.0
Poor Correlations		
N-S to FP and MP to FP	—.4635 ± .08	5.7
Angle of Convexity and OCC to FP	.4547 ± .08	5.6
Facial angle and N-S-GN	—.4073 ± .08	5.0
Facial angle and A-B to OCC	—.3848 ± .09	4.2
S-Gn to FP and A-B to OCC	.3737 ± .09	4.1
No Correlation		
N-S-GN and UIA to OCC	.3304 ± .09	3.6
N-S-GN and A-B to OCC	.3272 ± .09	3.6
Facial angle and LIA to MP	—.2897 ± .09	3.2
S-GN to MP and N-S to MP	—.2726 ± .09	3.0
Gonial angle and Angle of Convexity	.2480 ± .10	2.5
Facial angle and UIA to OCC	—.1538 ± .10	1.5

r = coefficient of correlation.
P Er = probable error.